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Realistic cosmological scenario with nonminimal kinetic coupling

Sushkov S.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

We investigate cosmological scenarios in the theory of gravity with the scalar field possessing a nonminimal kinetic coupling to the curvature. It is shown that the kinetic coupling provides an essentially new inflationary mechanism. Namely, at early cosmological times the domination of coupling terms in the field equations guarantees the quasi-de Sitter behavior of the scale factor: a(t)eH κt with H κ=1/√9κ, where κ10 -74sec2 is the coupling parameter. The primary inflationary epoch driven by nonminimal kinetic coupling comes to the end at t f10 -35sec. Later on, the matter terms are dominating, and the Universe enters into the matter-dominated epoch which lasts approximately 0.5H0-1~0.5×1018sec. Then, the cosmological term comes into play, and the Universe enters into the secondary inflationary epoch with a(t)eH Λt, where H Λ=√Λ/3. Thus, the cosmological model with nonminimal kinetic coupling represents the realistic cosmological scenario which successfully describes basic cosmological epochs and provides the natural mechanism of epoch change without any fine-tuned potential. © 2012 American Physical Society.

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